

1   **WHAT IS CLAIMED IS:**

2    1.     A method of controlling a drilling operation involving rotation of a bottom hole drilling  
3   assembly carried by a drillstring, comprising:

4         (a) obtaining real-time sensor data regarding at least one dynamic operational  
5             parameter of said bottom hole assembly;

6         (b) performing real-time analysis of said sensor data to calculate at least one dynamic  
7             critical value of an operator-adjustable operational parameter of said bottom hole  
8             assembly;

9         (c) presenting to an operator a display of the real-time value of said operator-adjustable  
10            operational parameter over time along with the real-time value of said at least  
11            one dynamic critical value of said operator-adjustable operational parameter.

12   2.     A method in accordance with claim 1, further comprising:

13         (d) providing means for an operator of said drilling operation to adjust the value of said  
14             operator-adjustable operational parameter to avoid said critical value.

15   3.     A method in accordance with claim 2, wherein said operator-adjustable operational  
16   parameter comprises rotational speed of said bottom hole assembly.

17   4.     A method in accordance with claim 1, wherein said real-time sensor data regarding at  
18   least one operational parameter includes without limitation vibrational data.

19   5.     A method in accordance with claim 4, wherein said vibrational data includes lateral  
20   vibration data.

21   6.     A method in accordance with claim 3, wherein said at least one critical value comprises  
22   a resonant frequency of said bottom hole assembly and drill string.

1     7.     An apparatus for carrying out a drilling operation involving rotation of a bottom hole  
2     drilling assembly carried by a drillstring, comprising:

3             a sensor for obtaining real-time sensor data regarding at least one dynamic operational  
4             parameter of said bottom hole assembly;

5             a dynamics analysis application for performing real-time analysis of said sensor data and  
6             calculating at least one dynamic critical value of an operator-adjustable  
7             operational parameter of said bottom hole assembly;

8             a display for presenting to an operator the real-time value of said operator-adjustable  
9             operational parameter over time along with the real-time value of said at least  
10            one dynamic critical value of said operator-adjustable operational parameter.

11    8.     An apparatus in accordance with claim 7, further comprising:

12            means for an operator of said drilling operation to adjust the value of said operator-  
13            adjustable operational parameter to avoid said critical value.

14    9.     An apparatus in accordance with claim 8, wherein said operator-adjustable operational  
15            parameter comprises rotational speed of said bottom hole assembly.

16    10.    An apparatus in accordance with claim 7, wherein said real-time sensor comprises a  
17            vibrational sensor.

18    11.    An apparatus in accordance with claim 10, wherein said vibrational sensor detects  
19            vibration in three orthogonal axes.

20    12.    An apparatus in accordance with claim 9, wherein said at least one critical value  
21            comprises a resonant frequency of said bottom hole assembly and drill string.

22    13.    A system for controlling a drilling operation involving rotation of a bottom hole drilling  
23            assembly carried by a drillstring, comprising:

1 a sensor for obtaining real-time sensor data regarding at least one dynamic operational  
2 parameter of said bottom hole assembly;  
3 a dynamics analysis application for performing real-time analysis of said sensor data and  
4 calculating at least one dynamic critical value of an operator-adjustable  
5 operational parameter of said bottom hole assembly;  
6 a display for presenting to an operator the real-time value of said operator-adjustable  
7 operational parameter over time along with the real-time value of said at least  
8 one dynamic critical value of said operator-adjustable operational parameter.

9 14. A system in accordance with claim 13, further comprising:

10 means for an operator of said drilling operation to adjust the value of said operator-  
11 adjustable operational parameter to avoid said critical value.

12 15. A system in accordance with claim 14, wherein said operator-adjustable operational  
13 parameter comprises rotational speed of said bottom hole assembly.

14 16. A system in accordance with claim 13, wherein said real-time sensor comprises a  
15 vibrational sensor.

16 17. A system in accordance with claim 16, wherein said vibrational sensor detects vibration  
17 in three orthogonal axes.

18 18. A system in accordance with claim 15, wherein said at least one critical value comprises  
19 a resonant frequency of said bottom hole assembly and drill string.